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**SMALL MAMMAL COMMUNITY FROM AN ISOLATED, REMNANT
CLOUD FOREST IN GUATEMALA**

Front cover: Small mammals from Cerro Cucurucho, Sacatepéquez, Guatemala. Top left, *Peromyscus beatae*. Top right, *Cryptotis goodwini*. Bottom left, *Peromyscus guatemalensis*. Bottom right, *Handleyomys rhabdops*. All photographs by Nicté Ordóñez-Garza.

SMALL MAMMAL COMMUNITY FROM AN ISOLATED, REMNANT CLOUD FOREST IN GUATEMALA

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ABSTRACT

Results are reported for a mammal survey in a remnant, isolated, mixed-hardwood cloud forest (2,640 m elevation) in Cerro Cucurucho, Sacatepéquez, Guatemala. Removal trapping for five nights (4–9 January 2013) with a total of 968 trap nights and 620 pitfall nights resulted in 46 captures representing 10 species of marsupials, shrews, and rodents. This study reports the abundance and reproductive activity of these small mammals. The small mammal community was dominated by *Peromyscus guatemalensis*. *Marmosa mexicana*, *Cryptotis goodwini*, *Sorex veraepacis*, *Heteromys desmarestianus*, *Peromyscus beatae*, *Reithrodontomys mexicanus*, *R. sumichrasti*, *Handleyomys rhabdops*, and *Nyctomys sumichrasti* were much less abundant. The diversity reported for this remnant forest was similar to that reported in other cloud forest habitats throughout Guatemala and highlights that, although Cerro Cucurucho represents a disturbed cloud forest habitat, the species diversity in the community is relatively high. Endoparasites (hymenolepid tapeworms), various ectoparasites, and mutualistic beetles (*Amblyopinus schmidtii*) were collected from the small mammals and are reported herein.

Key words: Cloud forest, Guatemala, mammals, marsupials, shrews, rodents, Sacatepéquez

RESUMEN

Se realizó un inventario de mamíferos menores en un remanente aislado de bosque nuboso (elevación 2,640 m) en el Cerro Cucurucho, Sacatepéquez, Guatemala. Las trampas se removieron y colocaron durante 5 noches consecutivas (4–9 Enero 2013). El total de noches de captura fue de 968 noches-trampa y 620 noches-pitfall, resultando en la colecta de 46 individuos de 10 especies de marsupiales, musarañas, y roedores. La diversidad reportada en este remanente de bosque se aproxima a la diversidad que se esperaría encontrar en habitats de bosque nuboso en Guatemala. La comunidad de mamíferos menores se encontró dominada por *Peromyscus guatemalensis*. Otras especies mucho menos abundantes fueron: *Marmosa mexicana*, *Cryptotis goodwini*, *Sorex veraepacis*, *Heteromys desmarestianus*, *Peromyscus beatae*, *Reithrodontomys mexicanus*, *R. sumichrasti*, *Handleyomys rhabdops*, y *Nyctomys sumichrasti*. Este estudio discute la actividad reproductiva de estos mamíferos, y enfatiza en que a pesar de que el habitat muestreado en el Cucurocho ha sido intervenido, la diversidad de especies para esta comunidad se mantiene relativamente alta. Además se reportan endoparásitos (tenias hymenolepidas), varios ectoparásitos, y escarabajos mutualistas (*Amblyopinus schmidtii*) que fueron colectados en los mamíferos menores durante el muestreo.

Palabras clave: Bosques nubosos, Guatemala, mamíferos, marsupiales, musarañas, roedores, Sacatepéquez

INTRODUCTION

Recent studies in the highlands of Guatemala have increased the knowledge of small mammal communities and distributions (Matson and McCarthy 2005; Matson et al. 2012; Ordóñez-Garza and Matson 2012; Woodman et al. 2012; Matson et al. in press) in Mesoamerica. However, our knowledge of terrestrial small mammals from Central American cloud forests remains meager, at best. Basic ecological data such as population structure, species diversity, life history information, and interactions between and among species generally are lacking for these areas. Some life history information is available from other areas for selected mammal species, although little information is available for most species (Janzen 1983 and papers therein; Timm et al. 1989; Timm and LaVal 2000; Vázquez et al. 2000; Matson et al. 2012; Woodman et al. 2012; Matson et al. in press).

Cloud forests serve as a major water source for human populations and provide valuable floral and

faunal elements. Throughout Central America these forests are severely threatened by on-going activities such as timber harvest and agriculture (Lawton et al. 2001). These activities along with illegal logging and land occupation, unsustainable agriculture, hunting, and uncontrolled forest fires are rapidly contributing to the habitat loss and consequently degradation of cloud forests (Hamilton et al. 1995; CEPF 2005). Aggravating the impact of these threats, the mammal species reported herein have small geographic ranges and are found in scattered areas at high risk of habitat loss. Therefore, it is fundamental to understand the contemporary patterns of species distributions and critical habitat associations. As part of a long-term effort to better determine the distributions and community structure of small mammals inhabiting highland habitats in Guatemala, we surveyed a remnant, isolated, mixed-hardwood cloud forest.

MATERIALS AND METHODS

The field survey was conducted in a remnant cloud forest (approximately 0.75 km²), on Finca El Pilar, Cerro Cucurucho (2,640 m), 11 km SE of Antigua Guatemala, Sacatepéquez, Guatemala, 14°31.115" N, -90°41.472" W (Fig. 1). The area has a nearly closed canopy at about 30 m composed of at least two species of oak (*Quercus* sp.), wild avocado (*Persea* sp.), and monkey hand tree (*Chiranthodendron pentadactylon*). Tree species were identified following Parker (2008). The understory is dominated by shrubs of the family Melastomataceae and various vines. The ground cover consisted of wet leaf litter to 15 cm deep.

Small terrestrial mammals were sampled using a combination of Museum Special snap traps (Woodstream Corp., Lititz, Pennsylvania), Victor Rat traps (Woodstream Corp., Lititz, Pennsylvania), and 3 x 3.5 x 9" Sherman collapsible live traps (Sherman traps Inc., Tallahassee, Florida) baited with a combination of

oats, peanut butter, and raisins. One-liter pitfall traps, constructed from empty plastic commercial yogurt containers, were set to capture shrews. Traps were set in informal transects that were 0.5 to 4 m apart, depending on habitat complexity, for a total of 968 trap nights and 620 pitfall nights. Trapping procedures, data collection, and animal handling followed the guidelines of the American Society of Mammalogists (Sikes et al. 2011) as approved by San Jose State University, Institutional Animal Care and Use Committee (Protocol 851). All specimens were identified following Reid (2009) and prepared as voucher specimens consisting of skin, skeleton, and tissue samples. All specimens are housed in the Museo de Historia Natural de la Universidad de San Carlos de Guatemala. Nomenclature, taxonomy, and phylogenetic order follow Wilson and Reeder (2005), except for *Handleyomys* for which we followed Weksler et al. (2006).

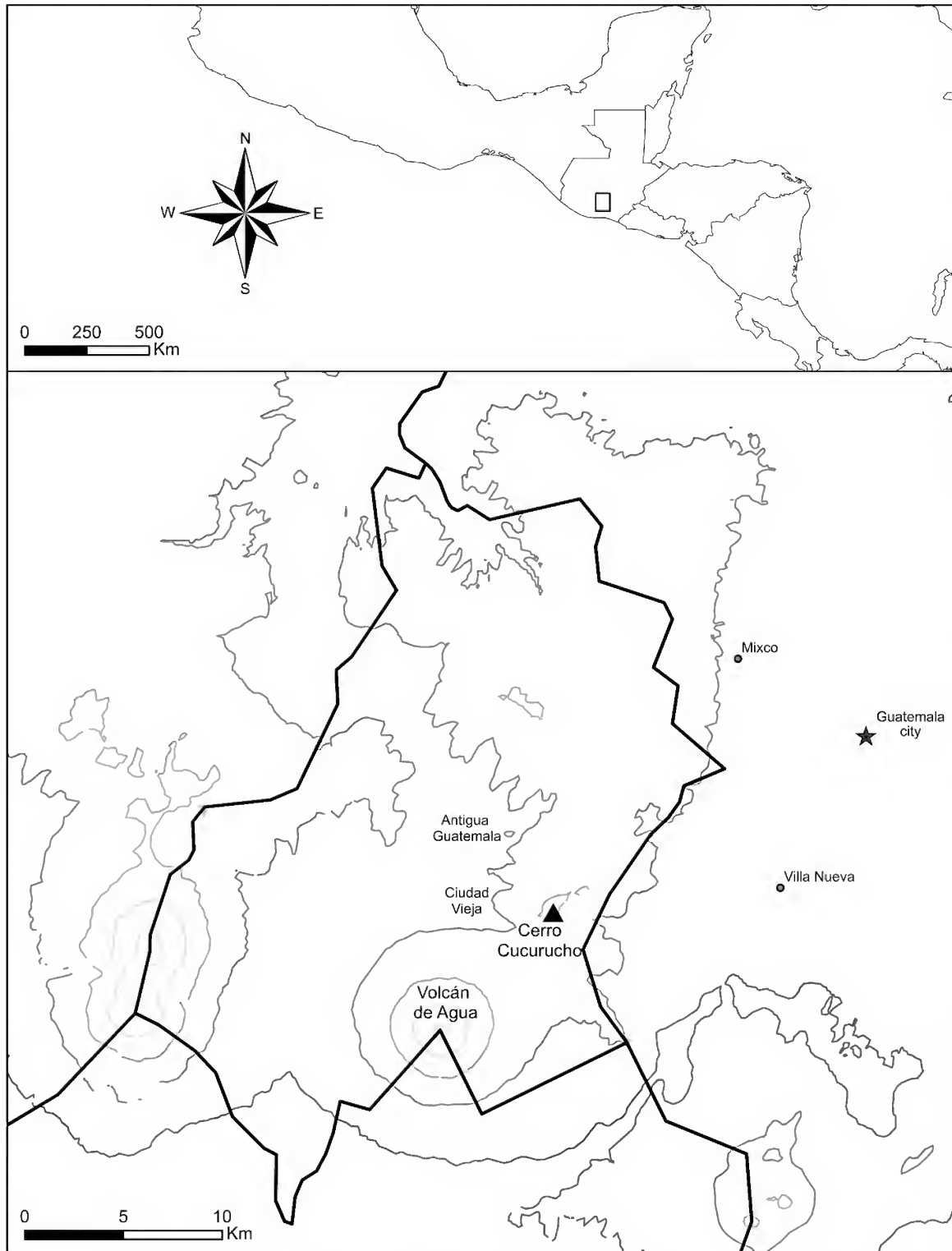


Figure 1. Map depicting Sacatepéquez and main features of the department. Contour lines represent elevational gradients. The triangle depicts the locality where samples were collected in Finca El Pilar, Cerro Cucurucho. Circles depict towns, names on the map depict other populated areas, and the star depicts the capital city of Guatemala.

RESULTS

During the survey, 46 individuals representing 10 species of small mammals were collected. The most abundant was *Peromyscus guatemalensis* (n = 20, 44%), followed by (in order of abundance): *Cryptotis goodwini* (n = 6, 13%), *Sorex veraepacis* (n = 5, 11%), *Reithrodontomys sumichrasti* (n = 4, 9%), *Handleyomys rhabdops* (n = 3, 7%), *Heteromys desmarestianus* (n = 2, 4%), *P. beatae* (n = 2, 4%), *R. mexicanus* (n = 2, 4%), *Marmosa mexicana* (n = 1, 2%), and *Nyctomys sumichrasti* (n = 1, 2%). All shrews were taken in pitfall traps, and the pitfalls did not capture any other species.

Trap success rates for marsupials and rodents was 3.6% (35 specimens per 968 trap nights) and for shrews was 1.8% (11 specimens per 620 pitfall nights).

Undescribed species of hymenolepid tapeworms (Hymenolepididae) were found in both species of shrew hosts. Some rodents harbored the mutualistic beetles *Amblyopinus schmidtii* (Coleoptera, Staphylinidae). Beetles were identified based on the morphology of the dissected aedeagus using the key of Ashe and Timm (1995).

SPECIES ACCOUNTS

ORDER DIDELPHIMORPHIA

Family Didelphidae

***Marmosa mexicana* Merriam 1897**

Mexican Mouse Opossum

One individual was captured with a museum special trap set on a fallen log approximately 1.5 m above the ground. The specimen was an adult male (scrotal testes present), and it did not have any ecto- or endoparasites. In Guatemala, this species is reported from several states (McCarthy and Pérez 2006), however this is the first report of *M. mexicana* for Sacatepéquez and a new high elevation record for this species in the country.

ORDER SORICOMORPHA

Family Soricidae

***Cryptotis goodwini* Jackson 1933**

Goodwin's Broad-clawed Shrew

Six adult individuals, three males and three females, were captured. All captures were in pitfall traps. In Guatemala, the reproductive season is reported to occur from April to July (Woodman et al. 2012) and during the collecting in January there was no evidence of reproductive activity. The specimens were collected within the elevational range reported for the species in the country (1,200 – 3,350 m; Woodman and Timm 1999). The individuals collected during January represent the first record for the species in Sacatepéquez, Guatemala.

***Sorex veraepacis* Alston 1877**

Verapaz Shrew

Five individuals, one male and four females, were collected in pitfall traps. The specimens collected did not show any evidence of reproductive activity. The specimens were in the elevational range previously recorded for the species in Guatemala (1,475 – 3,100 m; Woodman et al. 2012). These five individuals represent the first record of the species for Sacatepéquez, Guatemala.

ORDER RODENTIA

Family Heteromyidae

***Heteromys desmarestianus* Gray 1868**

Desmarest's Spiny Pocket Mouse

Two individuals, one female sub-adult and one male adult (scrotal testes), were collected. The species was reported previously for this region (McCarthy and Pérez 2006) and it is within the elevational range reported for the species.

Family Cricetidae

***Handleyomys rhabdops* (Merriam 1901)**

Highland Oryzomys

Two males and one female were collected and these represent the first record of the species for Sacatepéquez, Guatemala. Elevational range of this species

reaches 3,000 m (McCarthy and Pérez 2006). One of three *Handleyomys rhabdops* served as new host of *Amblyopinus schmidtii* (Coleoptera, Staphylinidae). The host specimen had one male beetle.

***Nyctomys sumichrasti* (Saussure 1860)**

Sumichrast's Vesper Rat

One female adult was collected during the trapping period. Tomes (1862) reported a vesper rat from Dueñas Sacatepéquez near where we collected this specimen. However, our record increases the known elevational range to 2,640 m.

***Peromyscus beatae* Thomas 1903**

Orizaba Deermouse

The two adult males (scrotal) collected represent the first record of the species for Sacatepéquez, Guatemala. The records for the country indicate that the species is distributed in the montane forest reaching elevations of 3,000 m (McCarthy and Pérez 2006). One of two *P. beatae* served as a new host of *Amblyopinus schmidtii* (Coleoptera, Staphylinidae). The host specimen had one female and one male beetles.

***Peromyscus guatemalensis* Merriam 1898**

Guatemalan Deermouse

Twenty individuals were collected of which 14 were males (12 adults, one subadult, and one juvenile), and six were females (five adults and one subadult).

All adult male *P. guatemalensis* had scrotal testes, an indication of reproductive activity. Of five adult female *P. guatemalensis*, one contained two embryos and another was lactating. This species is known from montane forest in the country below 3,100 m (McCarthy and Pérez 2006). This is the first record of *P. guatemalensis* for Sacatepéquez, Guatemala. Six of 20 specimens served as host of *Amblyopinus schmidtii*. The type host specimen had 4 male and 11 female beetles.

***Reithrodontomys mexicanus* (Saussure 1860)**

Mexican Harvest Mouse

Two adult individuals (one female and one scrotal male) were collected. The first record of the species for Sacatepéquez is by Tomes (1862), in the vicinity of Dueñas, Sacatepéquez. Our specimens from 2,460 m establish a new upper elevational range limit for this species in Guatemala; the previous upper elevation range was 2,200 m (McCarthy and Pérez 2006).

***Reithrodontomys sumichrasti* (Saussure 1861)**

Sumichrast's Harvest Mouse

Three adults (two males and one female) and one subadult female were collected. Of the females, only one showed evidence of reproductive activity (lactating and two placental scars). The first record of the species for Sacatepéquez is by Tomes (1862), in the vicinity of Dueñas, Sacatepéquez, a locality near where we collected the specimen.

DISCUSSION

The habitat in the Cerro Cucurucho cloud forest has been severely disturbed; however, the species diversity for this small mammal community remains relatively high, with 10 species collected in this survey. Ten species appears to be the modal number of species at any one locality (Rickart 1977; Matson and McCarthy 2005; Matson et al. 2012) throughout the cloud forest regions of Guatemala. However, Matson et al. (in press) recorded 15 species of small mammal from another isolated cloud forest at Chelemhá Cloud Forest Reserve, Sierra Yalijux, Alta Verapaz, Guatemala.

In this study, one species was clearly dominant, *Peromyscus guatemalensis*. Other studies from this region generally indicate that usually two species are dominant (Vásquez et al. 2000; Matson and McCarthy 2005; Matson et al. 2012; Matson et al. in press). In all cases, a species of *Peromyscus* was the dominant taxon in the community. Reproductive activity appears to be similar to that recorded for other cloud forest small mammals in Central America during the dry season (Rickart 1977; Vásquez et al. 2000; Matson et al. 2012; Matson et al. in press). Ectoparasites collected

from small mammals in this study included fleas, lice, mites, and ticks, not all of which have been identified. *Peromyscus beatae* and *Handleyomys rhabdops*

are new hosts for *Amblyopinus schmidtii* (Coleoptera, Staphylinidae), a species whose range is limited to the highlands of Guatemala and Chiapas, Mexico.

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